ATOP-R&D

Human Factors Newsletter # 04-09

April 24, 2004 – May 7, 2004

Technical Information: URET, TMA and CPDLC Collocation Study. Randy Sollenberger, Pam Della Rocco

An important goal of the FAA's Free Flight Program was the delivery of new air traffic control (ATC) technologies focused on early benefits to users of the National Airspace System (NAS). These capabilities included the User Request Evaluation Tool (URET), Traffic Management Advisor (TMA), and Controller-Pilot Data Link Communications (CPDLC) as en route controller tools. Under the Free Flight Program, these tools were successfully deployed to a limited number of Air Route Traffic Control Centers (ARTCCs) nationwide. Different designers developed URET, TMA, and CPDLC with the assumption that each system would operate independently. As deployment of the tools expands nationwide, several facilities may eventually receive all three tools. Before this occurs, the Free Flight Program Office (AOZ) and the Human Factors Research and Engineering Division (AAR-100) sponsored research to identify any potential human factors issues that may arise due to the collocation of these three tools at the controller's workstation.

URET is a conflict probe tool that automatically predicts and notifies controllers of aircraft-to-aircraft or aircraft-to-special use airspace conflicts. URET also has a trial planning feature that allows controllers to determine whether proposed flight path changes will conflict with traffic or airspace. TMA is an arrival sequencing tool that provides controllers with information for increasing the efficiency of traffic flow into airports. CPDLC is a communications tool that allows controllers and pilots to send and receive text-based electronic messages.

Researchers from the NAS Human Factors Group at the William J. Hughes Technical Center conducted a human-in-the-loop simulation to evaluate the impact of URET, TMA, and CPDLC collocation as independent tools on controller workload, situational awareness, and teamwork. Twelve Air Traffic Control Specialists (ATCSs) from ARTCCs nationwide participated in this study. We recruited six controllers from ARTCCs where URET was operational and six controllers from ARTCCs where TMA was operational so that our participants were already experienced with some of the tools. Also, all participants received some cross-training in URET and TMA as well as CPDLC training in our simulator. Each controller team consisted of one TMA-qualified ATCS operating the R-side (Radar) and one URET-qualified ATCS operating the D-side (Data) position.

The study consisted of three 2-week sessions with a different group of four ATCSs participating in each session. In the first week, controllers completed 18 hours of practice scenarios to become familiar with the generic airspace and the three tools. In the second week, we conducted three separate simulation experiments. The first experiment examined R-side/D-side controller teams working a high altitude sector and using different combinations of the three tools at a single sector. The second experiment examined controller teams interacting with each other while working a high and a low altitude sector and using all of the tools. The third experiment examined controllers working a high altitude sector alone without a D-side and using all of the tools.

We used a variety of techniques and tools to collect a large set of objective and subjective data. These measures included URET, TMA, and CPDLC usage, controller-to-pilot and controller-to-controller voice communications, aircraft flight time and distance, eye-tracking, situational awareness, workload, and subject-matter expert observations. We carefully analyzed the data using descriptive and inferential statistics to understand how controllers were using the tools in the simulation and identify any collocation human factors issues. We completed a quick look report and technote draft on the first experiment. We are processing the data from the second and third experiments for subsequent reports.

The most important collocation issue identified in this study was that controllers had difficulty accessing important information on the D-side display when URET and CPDLC were both operational (i.e., display clutter). Controller ratings indicated that CPDLC caused a great deal of display clutter on the D-side monitor. Neither URET alone nor CPDLC alone caused display clutter. However, both tools in combination made it difficult for D-side controllers to find the information they needed quickly. This was especially true for accessing CPDLC windows, which became covered when controllers used URET.

Another collocation issue identified in this experiment was that D-side controllers had to access TMA delay time information from the R-side display. Controllers thought it was important to have TMA information available on the D-side display where it could be easily accessed by D-side controllers. However, controllers were concerned that simply showing the TMA List on the D-side might add to the D-side display clutter.

In general, controllers rated their situational awareness as very high during the simulation. However, there was a situational awareness issue with the CPDLC Transfer of Communications (TOC) service. R-side controllers sent most of the CPDLC TOCs to aircraft. Although D-side controllers did not use the TOC service very often, controllers still expressed concern about not knowing what their team member was doing with CPDLC. Unlike voice communications, there were no audible cues with CPDLC to help controllers maintain situational awareness of their team member's actions. Controllers had to visually monitor the CPDLC Message Out window to know when their team member sent a TOC message. If the CPDLC display was covered by URET, the D-side controller could easily miss a sent message.

Finally, controller workload ratings indicated that D-side workload tended to increase when two and three tools were operational. However, D-side workload ratings were only moderate and never reached a high level in the moderate traffic scenarios we designed for the simulation. Good human factors design principles prescribe that users must have immediate access to important information and that critical information should never be covered. A "stovepipe" independent deployment of URET, TMA, and CPDLC could result in impaired access to timely information. The results of this study indicated that better human factors efforts should be made towards integrating the information from these three tools. Even if these systems cannot be entirely integrated, we should explore integrating the display of information on the D-side monitor prior to deployment.

Point of Contact: Randy L. Sollenberger, WJHTC ACB-220

RNAV: On April 16th, human factors researchers met with Air Traffic, NATCA, and Airway Facilities representatives from Northern California TRACON (NCT) to finalize logistics plans for a human factors study of a proposed Area Navigation (RNAV) approach to the San Francisco International Airport. A Western Pacific regional air traffic representative and a pilot from Alaska Airlines were also in attendance. The human-in-the-loop simulation will examine two different orientations for the non-transgression zone, as well as two communications configurations. The study will be conducted at NCT between May 17th and May 21st utilizing a portable version of the Distributed Environment for Simulation Rapid Engineering and Experimentation (DESIREE) Air Traffic simulator and the Target Generation Facility (TGF). This study will be the first of its kind taking simulation capability to a field facility and studying issues important to those operating the facility. What makes this capability different than that used for training at the TRACON is the integrated data collection built into the simulation itself. (E. Stein, WJHTC)

Shift Work: Crystal Cruz provided a 1.5-hour workshop on coping with shift work at the Professional Women Controller's Training Conference in Chicago, on April 22nd. The workshop was an optional activity in the evening and was attended by approximately 12 participants. The

workshop included history on past shift work research at CAMI, determining each participant's chronotype, information on circadian rhythms, myths about shift work, and information on how to cope with rapidly rotating shift schedules such as the 2-2-1. Participants indicated that the program was very helpful and that they would like to see this kind of workshop presented during the daytime portion of next year's conference. (C. Cruz, CAMI)

Aerospace Medical Association: CAMI personnel participated in the 75th Annual Scientific Meeting of the Aerospace Medical Association held in Anchorage, AK on May 3-6. A total of 19 scientific presentations were made during the meeting. Drs. Shappell and Boquet and Ms Cristy Detwiler provided a workshop on the Human Factors Analysis and Classification System (HFACS) for aviation personnel and conference attendees prior to the start of the meeting. Dr. Manning served as Chair of the Scientific Program Committee. She was responsible for review of the abstracts and organizing the program for the meeting. Dr. Shappell served as the Deputy Program Chair. Dr. Schroeder served as president of the association for the past year and will turn over the duties to the new president, Dr. Antunano.

Scientific presentations:

NAME	PAPER
Bert Boquet, C.A. Hackworth, C.E. Cruz, and T.E. Nesthus	Predicting Cardiovascular Symptomatology Among Shiftworking Air Traffic Personnel
Carla Hackworth, A.J. Boquet, C.E. Cruz, T.E., Nesthus, and L.M. Peterson	Predicting Job Satisfaction Within Shiftworking Air Traffic Personnel
Carol Manning	Relationship Between Controller Age and Use of an ATC Decision Support Tool
Carolyn Dollar and D. Schroeder	A Longitudinal Study of MBTI Personality Types in Air Traffic Controllers
Cristy Detwiler, A. Scarborough, D. Wiegmann, and S. Shappell	Beneath the Tip of the Iceberg: An In-depth Review of General Aviation Accidents in Alaska Versus the Rest of the U.S.
Crystal Cruz, A. Boquet, C.A. Hackworth, K. Holcomb, and T.E. Nesthus	Gender and Family Responsibilities as They Relate to Sleep and Fatigue Responses on the FAA Air Traffic Control Shiftwork Survey
Dana Broach	Impact of Motivational Distortion on Personality Scale Criterion-Related Validity in High Stakes Selection Process
Elaine Pfleiderer	Relationship of the Aircraft Mix Index with Performance and Objective Workload Evaluation Research (POWER) Measures
Freda Scarborough, C. Detwiler, D. Wiegmann, and S. Shappell	Human Error Analysis of General Aviation Accidents: Identification of Factors Associated with Phase of Flight

Julia Pounds, R. Breedlove, D. Thompson, D. Jack, and A. Ferrante	Evaluation of an ATC Cognitive Workout Program
Kevin Williams	Effectiveness of Capstone Navigational Displays Under Partial Panel Conditions
Larry Bailey, D. Schroeder, S. Goldman, and J. Pounds	An Initial Evaluation of the FAA's Air Traffic Control Operational Error Severity Index
Nelda Milburn and H.W. Mertens	Predictive Validity of the Aviation Lights Test for Testing Pilots With Color Vision Deficiencies
Ray King, C.A. Detwiler	Presentation Management and Self-Appraisal in Student Air Traffic Control Specialists
Roni Prinzo	Pilot Use of a Cockpit Display of Traffic-Information During Aircraft Navigation on the Airport Surface: An Analysis of Pilot/Controller Operational Communication
Scott Goldman and N. Nelson	Maintenance-related Accidents in Alaska: A Comparison to the Rest of the United States
Tom Nesthus, C.E. Cru, A.J. Boquet, and C.A. Hackworth	Risk Factors for Air Traffic Control Specialists Commuting to and from Early Morning and Midnight Shifts

Point of Contact: D. Schroeder, CAMI

Visit to China: Dr. Julia Pounds (CAMI) visited the Civil Aviation Flight University of China (CAFUC) in Guanghan City, Sichuan Province, China, April 12-16, 2004. CAFUC is reportedly the largest university for advanced civil aviation education in China and Asia, one of three colleges under the leadership of the Civil Aviation Administration of China (CAAC). Dr. Pounds toured the pilot and air traffic control training facilities, receiving briefings by CAFUC instructors on ATC and pilot selection and training procedures. While there, she gave four lectures on current FAA human factors research and met with several groups of faculty and students to discuss human factors research in the FAA and future directions of research at the CAFUC. (J. Pounds, CAMI)

Operational Errors: Dr. Julia Pounds (CAMI) and Ms. Deborah Thompson (OMNI Corp.) traveled to Washington, DC, April 20-21, and briefed Dr. Paul Krois, Deputy Director, Human Factors Research and Engineering Division, on initial results from a study to identify a common set of Temporal Markers for operational errors (OEs). This type of objective data would be used in concert with causal factors data to understand circumstances leading to OEs. While in Washington, DC, Dr. Pounds and Ms. Thompson attended a meeting of the Global Aviation Information Network (GAIN) Working Group (WG) B. At the request of the committee co-chair, Dr. Pounds provided the group with an impromptu briefing on the JANUS and NATPRO programs. (J. Pounds, CAMI)

Air Transportation Human Factors: NASA-Ames researchers have recently posted a "hot topic" feature on their web site (address below). They plan to periodically post a 1- 4 page paper discussing issues and questions in their research domain to stimulate interaction between the research community and the operational community. It is hoped this will provide a mechanism for anyone who is interested to respond to the hot topics. It is also a chance for the research community to learn about the challenges of concurrent task management and prospective memory in real-world settings, and for the aviation community to learn about the cognitive underpinnings of skilled performance. The topics will range from very operational to very theoretical. (E. Edens, AFS-230)
http://human-factors.arc.nasa.gov/ihs/flightcognition/

Award: On April 21st, Dr. Roni Prinzo traveled to McLean, Virginia to participate in the Annual Office of Aerospace Medicine Awards Ceremony. She received the William E. Collins Publication Award for her report entitled *Automatic Dependent Surveillance-Broadcast/Cockpit Display of Traffic Information: Pilot Use of the Approach Spacing Application.* (S. Schroeder, CAMI)

ICAO: Dr. Eleana Edens participated in the 12th meeting of the ICAO Human Factors working group in Montreal April 28-29, 2004. The study group helped develop a five-year human factors work plan for ICAO. Work topics also included threat and error management for cabin safety and pilot licensing. ICAO standards for NOTAMS will be modified to address the use of capitalization based on an FAA human factors study. (E. Edens, AFS-230)

Airline Training: Dr, Eleana Edens, presented the Air Transportion Human Factors Research Program overview at the World Airline Training/Regional Airline Training conference in Phoenix, May 4-5, 2004. Captain Janeen Kochran, a member of the FAA research team at the University of Central Florida, presented the latest FAA research on pilot training for unexpected events. (E. Edens, AAR-100)

News Articles:

In the January-March 2004 issue of ATCA's Journal of Air Traffic Control, there are two human factors-related articles that might be of interest to the research community -

- Bill Vaughan from the William J. Hughes Technical Center's Tower Integration Group, "Modeling and Simulation in the ATCT Siting Process"
- Michael Madson from NASA Ames, "Air Traffic Controllers and Real-time Simulation: A Powerful Combination"

Point of contact – P. Krois, ATOP-R&D

Human Factors Training Course: FAA employees and contractors are invited to take a course on Cognitive Task Analyses in the ATC Environment on May 19, from 9:00 a.m. – 4:00 p.m., at Northrup Grumman, 475 School Street, S.W., Conference Room B. You can find the course description on-line at
http://arms.faa.gov/groupcourse/index.cfm?&groupcourse_id=784&fuseaction=viewdesc. Please

see your training officer to sign up. For additional information, please contact Glen Hewitt/ATOP-R&D at (202) 267-7163.

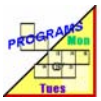
Flight Plan: The FAA's 2nd Quarter Flight Plan Performance Report for March 2004 is now available online. Go to the FAA home page at www.faa.gov and click "How are we performing?" under the Flight Plan 2004-2008 link. You will see how well we are meeting the 30 performance targets we've set for Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence in FY 2004.

This year, our goal is to meet at least 90 percent of our performance targets. We achieved that in this second quarter, meeting 27 of 30 targets. We have had no fatal commercial aviation accidents so far this year, and the accident rate is the lowest it has ever been. Nevertheless, we have areas for improvement. General aviation fatal accidents are up, on-time arrivals are down, and the FAA is working hard to fund some of the initiatives contained in our aggressive Flight Plan by reprioritizing and implementing cost control measures.

To reduce general aviation accidents, we are reinvigorating the General Aviation Joint Steering Committee, enhancing national safety programs, expediting Safer Skies initiatives for general aviation, improving human factors data, and supporting weather studies. Actions we are taking to improve on-time arrivals include working with the airlines on a joint Spring/Summer program to reduce delays, a new Growth without Gridlock program, and Collaborative Decision Making (CDM). On funding new initiatives, the FAA cost control program is now up and running.

More information on human factors research can be found at the FAA Human Factors (AAR-100) web site: http://www.hf.faa.gov

Mark D. Rodgers
FAA (AAR-100)



CALENDAR

May 10-12, 2004 – Royal Aeronautical Society 10th AIAA CEAS Aeroacoustics Conference, Manchester Town Hall, UK *http://www.aerosociety.com/homepage.asp*

May 10-13, 2004 – DOD TAG-51, Atlantic City, NJ *http://hfetag.dtic.mil/meetschl.html*

May 11-13, 2004 – SAE SEAT – Aircraft Seat Committee, Savannah, GA
mlemank@sae.org

May 17-18, 2004 - The Technical Cooperation Program, Human Resources and Performance Group (HUM)-TP9, Human Systems Integration Workshop, Ottawa, Ontario, Canada
http://hfetag.dtic.mil/news.html

May 18-20, 2004 – Aviation Industry Week, Las Vegas Convention Center, Las Vegas, NV *http://www.AviationIndustryWeek.com*

May 23-26, 2004 – Tenth International Conference on Mobility and Transport for Elderly and Disabled People, Hamamatsu, Japan http://trb.org/calendar/

May 25, 2004 - Human Factors Integration Symposium, MoD, Abbey Wood, Bristol, UK http://hfetag.dtic.mil/docs/HFI-Symposium-Flyer.doc

May 26-27, 2004 – Royal Aeronautical Society Conference – Flight Simulation 1929-2029, A Centennial Perspective, London, UK *http://www.aerosociety.com/homepage.asp*

June 7-11, 2004 – 2004 US/Europe International Aviation Safety Conference (FAA/JAA), Philadelphia, PA *http://www.jaa.nl/conference/20th/closing.html*

June 10, 2004 – FAA Human Factors Acquisition Working Group Meeting, Room 932, FOB10A, Wash., DC mailto:glen.hewitt@faa.fov

June 15-17, 2004 – SAE Digital Human Modeling for Design and Engineering Meeting, Oakland University, Rochester, Michi*gan* *http://www.sae.org/calendar/aeromtgs.htm*

June 22-24, 2004 – Civil/Military ATM Conference, Warsaw, Poland
http://www.atca.org/event_items.asp

July 8, 2004 - Human Factors Tool Symposium, Orlando, Florida
http://hfetag.dtic.mil/docs/NASA-Tools-Workshop.doc

July 15, 2004 – Deadline for papers - 13th Annual Symposium on Aviation Psychology (ISAP), Civil Aerospace Medical Institute (CAMI), Oklahoma City, OK, April 18-21, 2005..
http://www.cami.jccbi.gov/

July 19-25, 2004 – Farnborough International 2004, Farnborough Aerodrome, England
http://www.farnborough.com/

July 22-August 2, 2004 – 52nd Annual EAA AirVenture Fly-In, Wittman Field, Oshkosh, WI
EAA AirVenture Oshkosh 2004

July 27-August 2, 2004 – 52nd Annual AirVenture, Oshkosh, WI http://airventure.org/

July 28 – August 1, 2004 – 112th Convention of the American Psychological Association. Honolulu, Hawaii http://www.apa.org/convention

August 1-4, 2004 – Designing Interactive Systems, Cambridge, MA
http://www.sigchi.org/DIS2004/

August 8-12, 2004 – 31st International Conference on Computer Graphics and Interactive Techniques, Los Angeles Convention Center, Los Angeles, CA http://www.vr.clemson.edu/eyetracking/etra/2004/

August 16-19, 2004 - 6th Workshop on Risk Analysis and Safety Performance Measurements in Aviation, Crystal City, VA. http://aar400.tc.faa.gov/AAR424/Workshop2004/.

August 23-27, 2004 - SAE G-10 Human Behavioral Performance Committee Semiannual Meeting, Seattle, WA http://www.sae.org/standardsdev/aerospace/g10tag.htm

September 8-9, 2004 – Civil Aviation Safety Symposium 2004, Westin Hotel Galleria, Dallas, TX *http://www.asdnet.org/cass/default.htm*

September 20-24, 2004 – Human Factors and Ergonomics Society 48th Annual Meeting, Sheraton New Orleans Hotel, New Orleans, LA http://www.hfes.org/

September 27-29, 2004 – SAFE Association 42nd Annual Symposium, Grand America Hotel, Salt Lake City, UT *http://www.safeassociation.com/symposium.htm*

September 29 – October 1, 2004 – 2004 International Conference on Human Computer Interaction (HCI-Aero), Toulouse, France http://www.eurisco-international.com/hci-aero2004.

October, 2004 – 18th Airbus/JetBlue Human Factors Symposium, New York City, NY *http://www.airbus.com/customer/events.asp*

October 4-7, 2004 – SAE SEAT – Aircraft Seat Committee Meeting, Albuquerque, NM mlemank@sae.org

October 10-16, 2004 – ACM Multi-Media 2004, New York, NY http://www.mm2004.org/

October 12-14, 2004 – Shared Vision of Aviation Safety Conference, San Diego, CA http://www.aviationsafetyconference.com/index2.html

October 12-14, 2004 – 57th Annual Business Aviation Association Meeting and Convention, Las Vegas County Convention Center, Las Vegas, NV *http://web.nbaa.org/public/cs/amc/*

October 13-15, 2004 – Sixth International Conference on Multimodal Interfaces, Penn State University, State College, PA http://www.icmiplace.org/

October 18-19, 2004 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, DC *http://wwwsearch.nationalacademies.org/*

October 21-23, 2004 – Aircraft Owners and Pilots Association Expo 2004, Long Beach Convention and Entertainment Center, Long Beach, CA *http://www.aopa.org/expo/2003/virtual/*

October 23-27, 2004 – NordiCHI 2004, Tampere, Finland *http://www.cs.uta.fi/nordichi2004/*

October 24-27, 2004 – UIST 2004, 17th Annual ACM Symposium on User Interface Software and Technology, Santa Fe, NM http://www.acm.org/uist/

October 25-28, 2004 – SAE S-9 Cabin Safety Technical Committee Meeting, San Diego, CA mlemank@sae.org

October 25-28, 2004 – DoD Maintenance Seminar and Exhibition, Hilton Americas, Houston, TX *http://www.sae.org/calendar/aeromtgs.htm*

October 31, 2004 – ATCA Annual Conference and Exposition, Marriott Wardman Park Hotel, Wash., DC http://www.atca.org/event_items.asp#

November 4-5, 2004 – Royal Aeronautical Society Seminar Human Factors Training in Aviation Maintenance, RAF Bentley Priory, Stanmore, near Watford, North London *http://www.raes-hfg.com/xmhftraining.htm*

November 8-9, 2004 – European Aviation Training Symposium, Vienna, Austria http://www.at-events.com/eats/conference.asp

November 15-18, 2004 – 57th Annual International Air Safety Seminar ("Sharing Knowledge to Improve Safety"), Pudong Shangri-La Hotel, Shanghai, China http://www.flightsafety.org/seminars.html

January 9-13, 2005 – TRB 84th Annual Meeting, Washington, DC http://trb.org/calendar/

January 28, 2005 – Deadline for papers - 6th USA/Europe ATM Seminar, Baltimore, MD, June 2005 http://atmseminar.eurocontrol.fr/

April 11-15, 2005 – SAE 100th Anniversary World Congress, Cobo Hall, Detroit, MI *http://www.sae.org/congress/about/news/congressdates.htm*

April 17-22, 2005 – International Federation of Air Traffic Controller's Associations, Melbourne, Australia *http://www.ifatca.org/conferences/annual_conference.htm*

April 18-21, 2005 – 13th Annual Symposium on Aviation Psychology (ISAP), Civil Aerospace Medical Institute (CAMI), Oklahoma City, OK (note: call for papers deadline is July 15, 2004). http://www.cami.jccbi.gov/

May 9-12, 2005 - 76th Annual Scientific Meeting of the Aerospace Medical Association, Kansas City, MO *http://www.asma.org/*

June 2005 – 6th USA/Europe ATM Seminar, Baltimore, MD (note: call for papers deadline is January 28, 2005) http://atmseminar.eurocontrol.fr/

August 18-21, 2005 - 113th Convention of the American Psychological Association, Wash, DC http://www.apa.org/convention

September 12-16, 2005 – Interact 2005, Tenth IFIP TC13 International Conference on Human-Computer Interaction, Rome, Italy http://www.interact2005.org/

September 26-30, 2005 – Human Factors and Ergonomics Society 49th Annual Meeting, Royal Pacific Resort at Universal Orlando, Orlando, FL *http://hfes.org/meetings/menu.html*

October 24-25, 2005 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, *DC http://wwwsearch.nationalacademies.org/*

January 22-26, 2006 – TRB 85th Annual Meeting, Washington, DC http://trb.org/calendar/

Note: Calendar events in Italics are new since the last Newsletter

Comments or questions regarding this newsletter?
Please contact Bill Berger at (334) 271-2928
or via e-mail at bill.ctr.berger @faa.gov